

CLAIMS

1. An organic light-emitting device comprising
an organic layer of a one or more-layered structure
5 comprising at least one compound having a
phosphorescence lifetime of 880 ms or more at 77K.

2. The organic light-emitting device according
to claim 1, wherein the organic layer comprises at
least one compound having a phosphorescence lifetime
10 of 1100 ms or more.

3. The organic light-emitting device according
to claim 1 or 2, wherein the compound is contained in
a light-emitting layer.

4. The organic light-emitting device according
15 to claim 3, wherein the light-emitting layer
comprises at least one host material and at least one
light-emitting material.

5. The organic light-emitting device according
to claim 3 or 4, wherein the compound is a host
20 material.

6. The organic light-emitting device according
to claim 4 or 5, wherein the fluorescence lifetime at
77K of the host material of the light-emitting layer
is 5.8×10^5 or more times the fluorescence lifetime
25 of the light-emitting material of the light-emitting
layer.

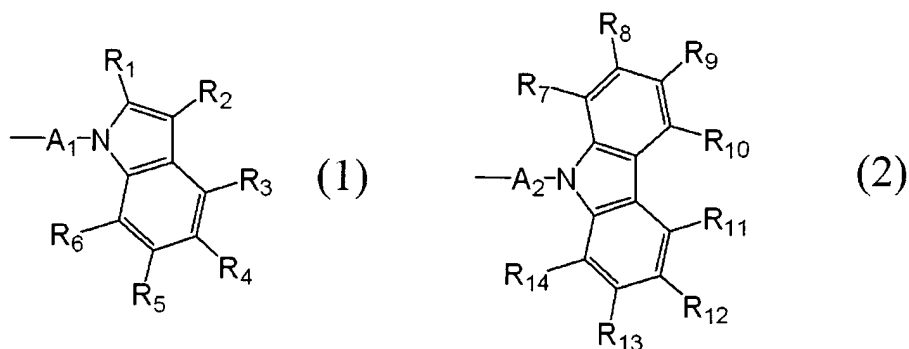
7. The organic light-emitting device according

to any one of claims 4 to 6, wherein the light-emitting material is a metal coordination compound.

8. The organic light-emitting device according to claim 7, wherein the metal coordination compound
5 is an iridium coordination compound.

9. The organic light-emitting device according to any one of claims 1 to 6, wherein the compound has, in a molecule, at least one partial structure comprising an unsubstituted or substituted indole
10 ring and at least one partial structure comprising an unsubstituted or substituted carbazole ring.

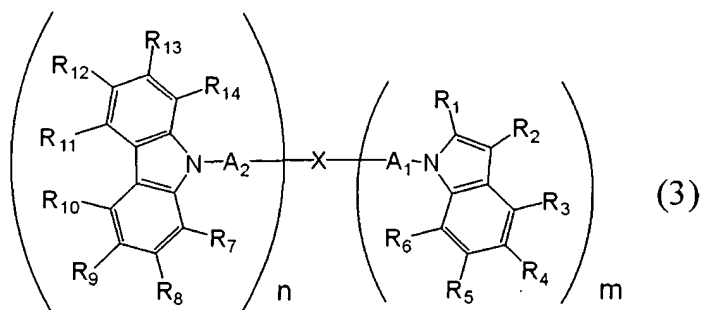
10. The organic light-emitting device according to claim 9, wherein the partial structure comprising the unsubstituted or substituted indole ring is
15 represented by the following general formula (1), and the partial structure comprising the unsubstituted or substituted carbazole ring is represented by the following general formula (2):



20 wherein A₁ and A₂ independently represents a single bond, an unsubstituted or substituted arylene group,

or an unsubstituted or substituted divalent heterocyclic group; and R₁, R₂, R₃, R₄, R₅, R₆, R₇, R₈, R₉, R₁₀, R₁₁, R₁₂, R₁₃, and R₁₄ are independently selected from an hydrogen atom, a halogen atom, a linear or branched alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, or -C≡C-, or one or more methylene groups may be replaced by an unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted aryl group, and an unsubstituted or substituted heterocyclic group, and adjacent ones of R₃, R₄, R₅, R₆, R₇, R₈, R₉, R₁₀, R₁₁, R₁₂, R₁₃, and R₁₄ may be bonded together to form a ring.

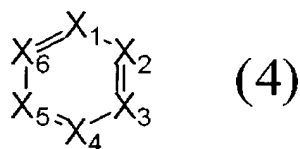
11. The organic light-emitting device according
to claim 10, wherein the compound is represented by
20 the following general formula (3):



wherein m and n are independently an integer of 1-5,

and the sum of m and n is an integer of 2-6, and X is an unsubstituted or substituted, m+n valent organic group.

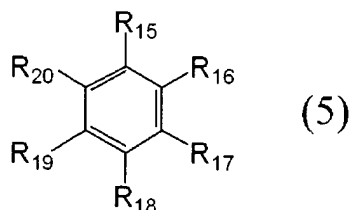
12. The organic light-emitting device according to claim 11, wherein the compound is represented by the following general formula (4):



wherein X₁ represents a nitrogen atom or C-R₁₅, X₂ represents a nitrogen atom or C-R₁₆, X₃ represents a nitrogen atom or C-R₁₇, X₄ represents a nitrogen atom or C-R₁₈, X₅ represents a nitrogen atom or C-R₁₉, X₆ represents a nitrogen atom or C-R₂₀, and the number of nitrogen atoms in X₁, X₂, X₃, X₄, X₅, and X₆ is 4 or less; R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is independently selected from an hydrogen atom, a halogen atom, a linear or branched alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, or -C≡C-, or one or more methylene groups may be replaced by an unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted aryl group, and an

unsubstituted or substituted heterocyclic group, with the proviso that at least one of R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is a partial structure comprising an indole ring represented by the general formula (1) and at least another of R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is a partial structure comprising a carbazole ring represented by the general formula (2).

13. The organic light-emitting device according to claim 12, wherein the compound is represented by the following general formula (5):



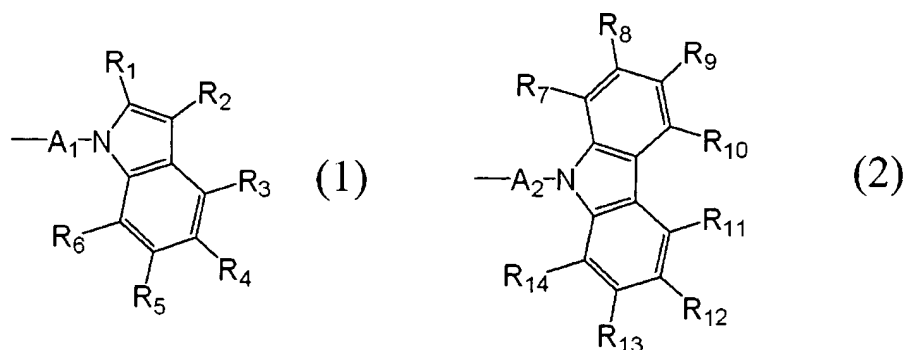
which corresponds to the general formula (4) in which X₁, X₂, X₃, X₄, X₅, and X₆ are all not nitrogen.

14. The organic light-emitting device according to claim 12 or 13, wherein at least three of R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ are independently a partial structure represented by the general formula (1) or (2).

15. An organic compound having, in a molecule, at least one partial structure comprising an unsubstituted or substituted indole ring and at least one partial structure comprising an unsubstituted or substituted carbazole ring.

16. The organic compound according to claim 15,

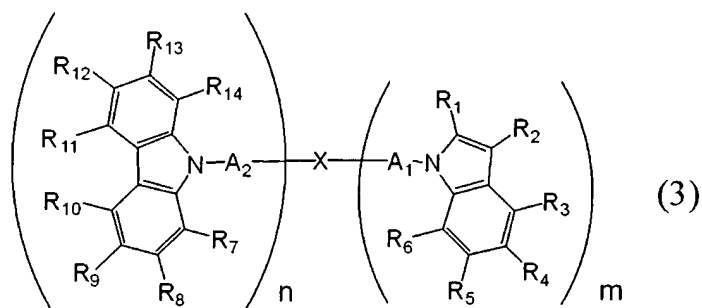
wherein the partial structure comprising the unsubstituted or substituted indole ring is represented by the following general formula (1), and the partial structure comprising the unsubstituted or substituted carbazole ring is represented by the following general formula (2):



wherein A_1 and A_2 independently represents a single bond, an unsubstituted or substituted arylene group, or an unsubstituted or substituted divalent heterocyclic group; and R_1 , R_2 , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , R_{10} , R_{11} , R_{12} , R_{13} , and R_{14} are independently selected from an hydrogen atom, a halogen atom, a linear or branched alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by $-O-$, $-S-$, $-CO-$, $-CO-O-$, $-O-CO-$, $-CH=CH-$, or $-C\equiv C-$, or one or more methylene groups may be replaced by an unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in

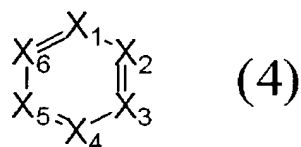
the alkyl group may be replaced by a fluorine atom),
 an unsubstituted or substituted aryl group, and an
 unsubstituted or substituted heterocyclic group, and
 adjacent ones of R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , R_{10} , R_{11} , R_{12} ,
 5 R_{13} , and R_{14} may be bonded together to form a ring.

17. The organic compound according to claim 16,
 which is represented by the following general formula
 (3):



10 wherein m and n are independently an integer of 1-5,
 and the sum of m and n is an integer of 2-6, and X is
 an unsubstituted or substituted, $m+n$ valent organic
 group.

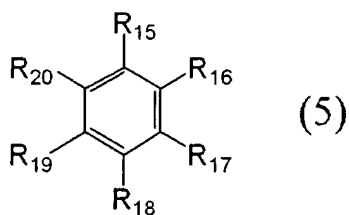
18. The organic compound according to claim 17,
 15 which is represented by the following general formula
 (4):



wherein X_1 represents a nitrogen atom or C- R_{15} , X_2
 represents a nitrogen atom or C- R_{16} , X_3 represents a
 20 nitrogen atom or C- R_{17} , X_4 represents a nitrogen atom

or C-R₁₈, X₅ represents a nitrogen atom or C-R₁₉, X₆ represents a nitrogen atom or C-R₂₀; R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is independently selected from an hydrogen atom, a halogen atom, a linear or branched
5 alkyl group having 1-20 carbon atoms (wherein one methylene group or two or more non-adjacent methylene groups of the alkyl group may be replaced by -O-, -S-, -CO-, -CO-O-, -O-CO-, -CH=CH-, or -C≡C-, or one or more methylene groups may be replaced by an
10 unsubstituted or substituted arylene group or an unsubstituted or substituted divalent heterocyclic group, and a hydrogen atom in the alkyl group may be replaced by a fluorine atom), an unsubstituted or substituted aryl group, and an unsubstituted or
15 substituted heterocyclic group, with the proviso that at least one of R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is a partial structure comprising an indole ring represented by the general formula (1) and at least another of R₁₅, R₁₆, R₁₇, R₁₈, R₁₉, and R₂₀ is a partial
20 structure comprising a carbazole ring represented by the general formula (2).

19. The organic compound according to claim 18, which is represented by the following general formula (5):



which corresponds to the general formula (4) in which X_1 , X_2 , X_3 , X_4 , X_5 , and X_6 are all not nitrogen.

20. The organic compound according to claim 18
 5 or 19, wherein at least three of R_{15} , R_{16} , R_{17} , R_{18} , R_{19} , and R_{20} are independently a partial structure represented by the general formula (1) or (2).

21. The organic light-emitting device according to any one of claims 3 to 8, wherein the light-
 10 emitting layer comprises a plurality of phosphorescent materials.

22. The organic light-emitting device according to any one of claims 1 to 14, which has the organic layer sandwiched by opposing two electrodes and emits
 15 light by application of a voltage between the electrodes.

23. An image display comprising the organic light-emitting device set forth in claim 22 and means for supplying an electric signal to the organic
 20 light-emitting device.